GCSE

Chemistry

CH3HP

Final Mark scheme

4402

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Version/Stage: v1.0

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.
At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.
In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.
2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.
2.3 Alternative answers acceptable for a mark are indicated by the use of **or**.
Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.
2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols/formulae

If a student writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown. However, if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.
Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation 'ecf' in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Accept/allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 Ignore/Insufficient/Do not allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain a marking point. Any further correct amplification could gain the marking point.
Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4. Quality of Written Communication and levels marking

In Question 2(c)(i) students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:
- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: Basic

- Knowledge of basic information.
- Simple understanding.
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail.
- The spelling, punctuation and grammar are very weak.

Level 2: Clear

- Knowledge of accurate information.
- Clear understanding.
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given.
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: Detailed

- Knowledge of accurate information appropriately contextualised.
- Detailed understanding, supported by relevant evidence and examples.
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	calcium/magnesium (ions) dissolve or go into solution from rocks	 allow limestone	1 1	**AO1** 3.2.1b
1(b)	solubility increases to 68 (°C) and/or until solubility reaches 59 (g/100g water) then decreases		1 1 1	**AO2** **AO3** 3.2.1b
1(c)	advantage: • good for bones **or** teeth **or** heart. disadvantage: • any **one** from: o scale o more soap used o scum o reduce efficiency of heating systems or kettles.	 ignore cost ignore time	 1 1	**AO1** 3.2.1a,e,f
1(d)	(Resin) contains sodium or hydrogen <u>ions</u> (so these ions) replace / exchange with (so water) no longer contains magnesium <u>ions</u> or calcium <u>ions</u>	 do **not** accept references to reactivity	1 1 1	**AO1** 3.2.1g
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	tick (✓) by: CH_3OH		1	**AO2** 3.6.1a
2(b)	tick (✓) by: C		1	**AO2** 3.3.1d
2(c)(i)			6	**AO1** **AO2** **AO3** 3.3.1a

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
no relevant content	some of the steps for a method **or** measurements are stated	a method **and** some measurements are described	a method **and** measurements are described which would allow a comparison to be made between the two alcohols

Examples of chemistry points made in response:

- measure mass or volume of water
- measure initial mass of ethanol (and burner)
- measure initial temperature of water
- ignite alcohol to heat the water
- stir water
- after a suitable temperature rise **or** time (or after a given volume is burned)
- extinguish the flame
- measure final temperature of water
- measure final mass of ethanol (and burner)
- repeat with next alcohol
- calculate the energy released and compare or compare temperature rise (for given mass of alcohol burnt or for given time of burning).

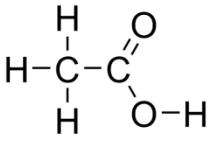
2(c)(ii)	lid **or** lagging **or** windshield **or** copper/metal container (so that) less energy lost (to surroundings) OR stir(rer) (1) (so that) energy distributed (1)	M2 dependent on M1 ignore digital thermometer ignore evaporation	 1 1	**AO3** 3.3.1a
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)(i)	any **one** from: • for undiscovered elements • so elements with similar properties were in same column / group	ignore so they fit the pattern	1	**AO1** 3.1.1b
3(a)(ii)	any **one** from: • they have different properties from elements above them • they are (transition) metals .	ignore electronic configuration ignore they did not fit the pattern allow transition elements	1	**AO1** 3.1.1a,b
3(b)(i)	7 electrons in outer shell / highest energy level	ignore gain of 1 electron	1	**AO2** 3.1.2b
3(b)(ii)	for bromine: outer shell closer to nucleus stronger force of attraction (to nucleus) electron more easily gained to outer shell	‘outer’ must be mentioned once for 3 marks. comparatives required. ignore references to bromide / iodide allow converse for iodine allow fewer shells allow smaller atom allow less shielding	1 1 1	**AO1** **AO2** 3.1.3g,h

3(c)(i)	yellow precipitate	allow yellow or dark yellow or light yellow or pale yellow allow dark yellow or light yellow or pale yellow precipitate allow dark yellow or light yellow or pale yellow ppt allow dark yellow or light yellow or pale yellow solid do **not** allow yellow solution	1	**AO1** 3.4.1e

3(c)(ii)	green precipitate	allow green or dark green or light green or pale green or dirty green allow dark green or light green or pale green or dirty green precipitate allow dark green or light green or pale green or dirty green ppt allow dark green or light green or pale green or dirty green solid do **not** allow green solution	1	**AO1** 3.4.1b

3(d)	one colour obscures the other	allow colours mix / blend allow only one colour seen	1	**AO3** 3.4.1a

3(e)(i)		allow -OH in the structure without the -O-H bond shown	1	**AO1** 3.6.2a

3(e)(ii)	weak acid	allow converse for hydrochloric acid	1	**AO3** 3.6.2a,b
	(because) ethanoic acid is not fully ionised / dissociated	allow (the solution) has a lower concentration of hydrogen ions allow (produces) fewer hydrogen ions. do **not** allow ionising	1	
Total			**12**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)(i)	2 (K +) 2 (H_2O →) 2 (KOH) + H_2	allow multiples allow H_2 for 1 mark allow 2 (K +) 2 (H_2O →) 2 (KOH) + 2H for 1 mark	2	**AO1** **AO2** 3.1.3a
4(a)(ii)	any **two** from: • potassium reacts more quickly / vigorously • potassium moves around more quickly • more bubbles from potassium • potassium melts • potassium produces a (lilac) flame	accept converse for Li allow dissolves more quickly allow more gas / hydrogen from potassium allow potassium catches fire	2	**AO1** **AO3** 3.1.3a
4(b)	add alkali to acid from burette until indicator changes colour take reading of volume at start and end repeat (and find mean) any **one** from • swirl / stir • add dropwise / slowly • white tile • rinse apparatus • meniscus • read at eye level	allow alternative apparatus for measuring volume allow appropriate use of pH probe allow record the volume used	1 1 1 1 1	**AO1** **AO3** 3.4.1g

4(c)	0.21	if incorrect, 26.25 x 0.2/1000 or 0.00525 for 1 mark their moles x 1000/25.00 or their moles x 40 for 1 mark correct evaluation for 1 mark 0.19(0476…) gains only 1 mark with or without working	3	**AO2** 3.4.1h
Total			**12**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	high temp increases rate	allow converse for low temperature	1	**AO1** **AO2**
	but decreases yield	allow shifts equilibrium to the left	1	**AO3** 3.5.1d,e,f,h
	because (forward) reaction is exothermic **or** so this (temperature) is a compromise	this mark dependent on M2 this mark dependent on both M1 and M2	1	
5(a)(ii)		allow converse for low pressure		**AO1**
	high pressure increases yield	allow shifts equilibrium to the right	1	**AO2** 3.5.1d,g,h
	(because) more moles / molecules of gas on LHS	allow (because) greater volume of gas on LHS If no other mark gained, allow 1 mark for high pressure increase rate because molecules closer together **or** increased frequency of collisions.	1	
5(a)(iii)	any **one** from: • less risk of explosion/safer • less energy required • less likely to leak.	allow converse for high pressure ignore cost / strength of plant	1	**AO3** 3.5.1g

5(b)	white precipitate (forms) with aluminium, the ppt dissolves in excess **or** with magnesium, the ppt does not dissolve in excess		1 1	**AO1** 3.4.1b
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)(i)	natural gas or water / steam	allow methane / crude oil / petroleum ignore processes	1	**AO1** 3.5.1a
6(a)(ii)	cool to any temp in the range -33 to -196 °C because (at this temperature) ammonia becomes a liquid **or** ammonia condenses		1 1	**AO1** **AO3** 3.5.1b
6(b)(i)	81(kJ)	ignore sign ((4 x 391 + 160) =) 1724 for 1 mark, and ((2 x 432 + 941) =) 1805 for 1 mark correct subtraction using one correct value for 1 mark	3	**AO2** 3.3.1f
6(b)(ii)	because energy taken in to break bonds is less than energy given out when bonds form	allow converse	1 1	**AO1** 3.3.1e,f
Total			**8**	